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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/493,662	01/28/2000	Zion Hadad		2515

7590 03/13/2003

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EXAMINER
PHAN, MAN U

ART UNIT	PAPER NUMBER
2665	

DATE MAILED: 03/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

N.K.

Office Action Summary

Application No.	Applicant(s)
09/493,662	Hadad
Examiner	**Art Unit**
Man Phan	2665

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Jan 28, 2000*

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideratio

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-9 and 14-16* is/are rejected.

7) ☒ Claim(s) *10-13* is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *Jan 28, 2000* is/are a) ☐ accepted or b) ☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examine

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. The application of Hadad for a "OFDM communication channel" filed 01/28/2000 has been examined. Claim 1-16 are pending in the application.

Specification

2. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 250 words. It is important that the abstract not exceed 250 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

The Abstract of the disclosure is objected to because it contains the legal phraseology "means" and "said". Correction is required.

Drawings

3. This application has been filed with informal drawings which are acceptable for examination purposes only. Formal drawings will be required when the application is allowed.

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: Reference character (28), (281-284) as shown in Fig. 3. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (US#6,470,030) in view of Seki et al. (US#5,771,224).

With respect to claim 1, Park et al. (US#6,470,030) discloses an orthogonal frequency division multiplexing (OFDM) receiver system comprising: means for extracting pilot signals contained in the OFDM received signal (Fig. 11D; Col. 13, lines 6-9); means for analyzing the pilot signals in the frequency domain and for issuing a signal indicative of a synchronization error (Fig. 2; Col. 4, lines 59-63 Col. 11, lines 34-35). Park does not expressly disclose the means for correcting the synchronization error responsive to the signal indicative of the synchronization error. However, Park suggests a synchronizing section for receiving the output of the pilot signal decoding section, performing coarse time synchronization, coarse frequency synchronization, frame synchronization, fine frequency synchronization and fine time synchronization, estimating a phase noise and correcting the same (Fig. 10; Col. 2, lines 29-35). In the same field of endeavor, Seki et al. (US#5,771,224) discloses in Fig. 4 illustrated block diagram of an OFDM receiver, in which an automatic frequency control (AFC) circuit 25 detects a frequency error of the regenerative carrier on the basis of the frequency of the OFDM modulated signal from the quadrature detector 23 and produces a signal used to control the frequency of the regenerative carrier. The frequency control signal is fed back to the quadrature detector 23 to control the frequency of the regeneration carrier produced within the quadrature detector, thereby achieving carrier synchronization (Col. 9, lines 19-28).

Regarding claims 2 and 3, Park et al. discloses in Fig. 10 a block diagram of a

pilot signal decoding section for performing time synchronization in the OFDM receiver, in which the means for extracting pilot signals comprise FFT means and signal processing means in the frequency domain (Col. 12, lines 32-35). Park further teaches that the means for extracting pilot signals, the means for analyzing the pilot signals and the means for correcting the synchronization error operate continuously in real time to keep the OFDM receiver synchronized (Col. 2, lines 22-44).

One skilled in the art would have recognized the need for effectively and efficiently achieving time synchronization in OFDM using signal processing of pilot signals in the channel, and would have applied Seki's novel use of the automatic frequency control (AFC) circuit for detecting a frequency error in the OFDM modulated signal into Park's teaching of an improved OFDM receiver system. Therefore, It would have been obvious to a person of ordinary skill in the art at the time of the invention was made to apply Seki's OFDM transmission system and transmitter and receiver therefor into Park's OFDM receiver system with the motivation being to provide a method for improvements in OFDM based digital communications.

7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (US#6,470,030) in view of Seki et al. (US#5,771,224), as applied to claim 1 above, and further in view of Saints et al. (US#5,872,775).

With respect to claim 4, this claim differs from claim 1 above in that the claim requires for measuring the rate of rotation of the pilot signals. Saints et al. (US#5,872,775) discloses a method and system for determining at a receiver of a variable

rate communication system including measuring the rate of rotation of the pilot signals (Fig. 3; Col. 7, lines 13-17).

One skilled in the art would have recognized the need for effectively and efficiently achieving time synchronization in OFDM using signal processing of pilot signals in the channel, and would have applied Saints' rate determination element and Seki's novel use of the automatic frequency control (AFC) circuit for detecting a frequency error in the OFDM modulated signal into Park's teaching of an improved OFDM receiver system. Therefore, It would have been obvious to a person of ordinary skill in the art at the time of the invention was made to apply Saints' method and apparatus for performing rate determination and Seki's OFDM transmission system and transmitter and receiver therefor into Park's OFDM receiver system with the motivation being to provide a method for improvements in OFDM based digital communications.

8. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seki et al. (US#5,771,224) in view of Martinez et al. (US#5,809,096).

With respect to claims 5 and 6, Seki et al. (US#5,771,224) discloses in Fig. 10 a block diagram of an OFDM receiver for use in a mobile communication includes achieving a more accurate frequency synchronization of the regenerative carrier by adding a signal representing the frequency error to an output signal of the automatic frequency correction (AFC) circuit 25 and then applying to the control section of the local oscillator (LO) of the quadrature detector 23 (Col. 14; lines 39-45). However, Seki does not expressly disclose the inner and outer frequency correction loop for correcting the LO

frequency. Martinez et al. (US#5,809,096) discloses the synchronization means including an inner frequency correction loop (first loop 1) for generating a local oscillator (LO) frequency related to a frequency of a received signal, and an outer frequency correction loop (second loop 2) for correcting the local oscillator (LO) frequency according to instructions received from a base station; and includes means for locking to the frequency of the received signal (Col. 1; lines 43-51 and Col. 3, lines 35-43)

Regarding claim 7, Seki further teaches in Fig. 4 shows a block diagram forming the principal parts of an OFDM receiver, in which a timing regeneration circuit 26, which regenerates timing signals, such as a symbol sync signal, a frame sync signal, and the like, and a clock signal on the basis of the reference symbol contained in the OFDM modulated signal, and supplies them to each circuit in the receiver. The timing regeneration circuit 26 generates an FFT window indicating the effective symbol portion of the OFDM symbol and then supplies it to a fast discrete Fourier transformer (FFT) 24. (Col. 9, lines 29-38).

One skilled in the art would have recognized the need for effectively and efficiently achieving time synchronization in OFDM using signal processing of pilot signals in the channel, and would have applied Martinez's teaching of the frequency correction loop in synchronization into Seki's novel use of the automatic frequency control (AFC) circuit for detecting a frequency error in the OFDM modulated signal. Therefore, It would have been obvious to a person of ordinary skill in the art at the time of the invention was made to apply Martinez's digital transmission system comprising decision means for changing the synchronization mode into Seki's OFDM transmission

system and transmitter and receiver therefor with the motivation being to provide a method for improvements in OFDM based digital communications.

9. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (US#6,470,030) in view of Seki et al. (US#5,771,224), and further in view of Alamouti et al. (US#5,933,421).

With respect to claim 8, Park et al. (US#6,470,030) discloses an orthogonal frequency division multiplexing (OFDM) receiver system comprising: means for extracting pilot signals contained in the OFDM received signal (Fig. 11D; Col. 13, lines 6-9); means for analyzing the pilot signals in the frequency domain and for issuing a signal indicative of a synchronization error (Fig. 2; Col. 4, lines 59-63 Col. 11, lines 34-35). Park does not expressly disclose the means for correcting the synchronization error responsive to the signal indicative of the synchronization error. However, Park suggests a synchronizing section for receiving the output of the pilot signal decoding section, performing coarse time synchronization, coarse frequency synchronization, frame synchronization, fine frequency synchronization and fine time synchronization, estimating a phase noise and correcting the same (Fig. 10; Col. 2, lines 29-35). In the same field of endeavor, Seki et al. (US#5,771,224) discloses in Fig. 4 illustrated block diagram of an OFDM receiver, in which an automatic frequency control (AFC) circuit 25 detects a frequency error of the regenerative carrier on the basis of the frequency of the OFDM modulated signal from the quadrature detector 23 and produces a signal used to control the frequency of the regenerative carrier. The frequency control signal is fed back

to the quadrature detector 23 to control the frequency of the regeneration carrier produced within the quadrature detector, thereby achieving carrier synchronization (Col. 9, lines 19-28). Park and Seki do not disclose the distortion in each pilot signal wherein each of the pilot distortion signals comprises both amplitude and a phase component. Alamouti et al. (US#5,933,421) teaches that selected tones within each tone set are designated as pilots distributed throughout the frequency band. Pilot tones carry known data patterns that enable an accurate channel estimation. The series of pilot tones, having known amplitudes and phases, have a known level and are spaced apart by approximately 30 KHz to provide an accurate representation of the channel response (i.e., *the amplitude and phase distortion introduced by the communication channel characteristics*) over the entire transmission band (Fig. 3; Col. 7, lines 13-17).

Regarding claim 9, Alamouti further teaches that for a particular traffic channel, the appropriate tones are selected using a demultiplexe, and wherein the correction of the received signal is performed in the complex domain, to include both gain and phase correction (Fig. 1.15; Col.17, lines 37-48).

One skilled in the art would have recognized the need for effectively and efficiently achieving time synchronization in OFDM using signal processing of pilot signals in the channel, and would have applied Saints' rate determination element and Seki's novel use of the automatic frequency control (AFC) circuit for detecting a frequency error in the OFDM modulated signal into Park's teaching of an improved OFDM receiver system. Therefore, It would have been obvious to a person of ordinary

skill in the art at the time of the invention was made to apply Saints' method and apparatus for performing rate determination and Seki's OFDM transmission system and transmitter and receiver therefor into Park's OFDM receiver system with the motivation being to provide a method for improvements in OFDM based digital communications.

10. Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (US#6,470,030) in view of Seki et al. (US#5,771,224), and further in view of Seki et al. (US#5,694,389).

With respect to claims 14-16, Park et al. (US#6,470,030) discloses an orthogonal frequency division multiplexing (OFDM) receiver system comprising: means for extracting pilot signals contained in the OFDM received signal (Fig. 11D; Col. 13, lines 6-9); means for analyzing the pilot signals in the frequency domain and for issuing a signal indicative of a synchronization error (Fig. 2; Col. 4, lines 59-63 Col. 11, lines 34-35). Park does not expressly disclose the means for correcting the synchronization error responsive to the signal indicative of the synchronization error. However, Park suggests a synchronizing section for receiving the output of the pilot signal decoding section, performing coarse time synchronization, coarse frequency synchronization, frame synchronization, fine frequency synchronization and fine time synchronization, estimating a phase noise and correcting the same (Fig. 10; Col. 2, lines 29-35). In the same field of endeavor, Seki et al. (US#5,771,224) discloses in Fig. 4 illustrated block diagram of an OFDM receiver, in which an automatic frequency control (AFC) circuit 25 detects a frequency error of the regenerative carrier on the basis of the frequency of the

OFDM modulated signal from the quadrature detector 23 and produces a signal used to control the frequency of the regenerative carrier. The frequency control signal is fed back to the quadrature detector 23 to control the frequency of the regeneration carrier produced within the quadrature detector, thereby achieving carrier synchronization (Col. 9, lines 19-28). Park and Seki do not disclose the equalizer means for reducing multipath. Since radio channels often are subjected to multipath propagation, the receiver needs to comprise some sort of equalizer to eliminate this phenomenon. Seki et al. (US#5,694,389) teaches in Fig. 5 an OFDM receiver, in which the equalizer means (305) used for reducing multipath, wherein the parameters of the equalizer are controlled by the signals indicative of multipath reflections; wherein the analyzing means comprise processing in the frequency domain, followed with an IFFT (Fig. 5; Col. 6, lines 33-37).

One skilled in the art would have recognized the need for effectively and efficiently achieving time synchronization in OFDM using signal processing of pilot signals in the channel, and would have applied Seki' s teaching of the equalizer for reducing multipath in OFDM receiver, and the novel use of the automatic frequency control (AFC) circuit for detecting a frequency error in the OFDM modulated signal into Park's teaching of an improved OFDM receiver system. Therefore, It would have been obvious to a person of ordinary skill in the art at the time of the invention was made to apply Seki' OFDM transmission/reception system and transmitting/receiving apparatus, and Seki's OFDM transmission system and transmitter and receiver therefor into Park's OFDM receiver system with the motivation being to provide a method for improvements in OFDM based digital communications.

Allowable Subject Matter

11. Claims 10-13 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for the indication of allowable subject matter: The prior art of record fails to disclose or suggest wherein the channel sounder including means for computing an average distortion of two adjacent pilots and for using that average to correct the information between these pilots; means for computing, for each frequency between two adjacent pilots, an interpolated value of the distortion, and for using that interpolated value to correct the information at that frequency , as specifically recited in the claims.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The Isaksson et al. (US#5,812,523) is cited to show the method and device for synchronization at OFDM system

The Kishimoto et al. (US#6,314,083) is cited to show the frequency control device and method for frequency synchronization with multiplex signal by OFDM, receiving device, and communication device.

The Sugita et al. (US#5,608,764) is cited to show the OFDM synchronization demodulation circuit.

The Kim (US#6,459,679) is cited to show the method and apparatus for synchronizing OFDM receiver.

The McGibney (US#6,021,110) is cited to show the OFDM timing and frequency recovery system.

The Wu et al. (US#6,370,188) is cited to show the phase and frequency offset compensation in a telecommunications receiver..

The Saiki (US#6,091,702) is cited to show the method and apparatus for symbol synchronization in OFDM systems.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to M. Phan whose telephone number is (703)305-1029. The examiner can normally be reached on Mon - Fri from 6:30 to 3:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Huy Vu, can be reached on (703) 308-6602. The fax phone number for the organization where this application or proceeding is assigned is (703)305-3988.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

13. **Any response to this action should be mailed to:**

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to: (703) 872-9314, (for formal communications intended for entry)

Or: (703) 305-3988 (for informal or draft communications, please label "PROPOSED" or "DRAFT")

Hand-delivered responses should be brought to Crystal Park II, 2021 Crystal Drive, Arlington. VA., Sixth Floor (Receptionist).

Mphan

03/05/2003.

Mai Phan